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## WEARABLE KEYBOARD APPARATUS

### BACKGROUND OF THE INVENTION

#### 1. Technical Field:

5 The present invention relates generally to an improved data processing system, and in particular to an apparatus for facilitating user input. Still more particularly, the present invention provides an apparatus for receiving user inputs using a wearable keyboard.

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#### 2. Description of Related Art:

Wearable computers are becoming tools in a user's environment much like a pencil or a reference book. A wearable computer is a computer that is subsumed or integrated into the personal space of a user and controlled by the user. The wearable computer provides automatic, portable access to information. Furthermore, the information can be automatically accumulated by the system as the user interacts with or modifies the environment thereby eliminating the costly and error-prone process of information acquisition.

Advances in semiconductor technology have made possible high performance microprocessors requiring less power and less space. Further, miniature heads up displays have recently been introduced in which these displays weigh less than a few ounces. These advances along with those in wireless communications technology make possible the shift from computers at a desk to wearable computers.

30 Challenges still exist in designing wearable computers. Optimally, wearable computers should offer

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seamless integration of information processing tools with the user. It is desirable to offer functionality in a natural and unintrusive manner. Conventional methods of interaction, such as the use of a conventional keyboard or mouse reduce the functionality of wearable computer system. One solution is to integrate the keyboard within the clothing of a user. Keyboard switches have been imbedded within fabric to create a wearable keyboard. One problem with this type of keyboard is that a user is unable to determine where a particular key or switch is located by feel alone. The user is required to look at the fabric to see the symbols identifying the keys. As a result, the user is unable to focus on other items.

Therefore, it would be advantageous to have an improved apparatus for facilitating user input.

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**SUMMARY OF THE INVENTION**

The present invention provides a keyboard apparatus,  
5 which includes a fabric and switch units coupled to the  
fabric. Each switch unit includes a capsule containing an  
electrically responsive liquid, wherein the electrically  
responsive liquid causes the capsule to increase in  
rigidity in response to application of an electric field  
10 to the electrically responsive liquid. Each switch unit  
also includes a switch coupled to the capsule; wherein a  
selected pressure applied to the capsule activates the  
switch. The keyboard apparatus also contains electrical  
conducting lines connected to the switch units.

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**BRIEF DESCRIPTION OF THE DRAWINGS**

The novel features believed characteristic of the  
5 invention are set forth in the appended claims. The  
invention itself, however, as well as a preferred mode of  
use, further objectives and advantages thereof, will best  
be understood by reference to the following detailed  
description of an illustrative embodiment when read in  
10 conjunction with the accompanying drawings, wherein:

**Figure 1** is a diagram of a wearable keyboard in  
accordance with a preferred embodiment of the present  
invention;

15 **Figure 2** is a diagram of a wearable keyboard in  
accordance with a preferred embodiment of the present  
invention;

20 **Figure 3** is a block diagram of a data processing  
system in accordance with a preferred embodiment of the  
present invention;

**Figure 4** is a block diagram of a wearable keyboard  
in accordance with a preferred embodiment of the present  
invention; and

25 **Figures 5A-5C** are diagrams illustrating a switch  
unit in a wearable keyboard in accordance with a  
preferred embodiment of the present invention.

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**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

With reference now to the figures, and in particular  
5 with reference to **Figure 1**, a diagram of a wearable  
keyboard is depicted in accordance with a preferred  
embodiment of the present invention. Wearable keyboard  
100 takes the form of an apron in this example. The  
keyboard switches, also referred to as "keys", are  
located in sections 102 and 104 of apron 100. In this  
example, the keys are split in to two sides to allow for  
easier reach by a user depending on the implementation  
all of the keys, and may be located in a single region or  
in multiple regions. These keys may be designed to  
15 provide input similar to a traditional key in which  
individual keys represent a single character or symbol.

Alternatively, the keys may be set up in a chording  
keyboard arrangement in which a chord combination may  
represent letters, numbers, words, commands, or other  
20 strings. Chording keyboard systems are smaller and have  
fewer keys than a traditional keyboard. Instead of the  
typical sequential, one-at-a-time key presses, chording  
requires simultaneous key presses for each character  
typed, similar to playing a musical chord on a piano.  
25 The mechanism of the present invention may be implemented  
using any type of keyboard system.

The present invention provides a keyboard with  
metallic fibers or conductors connected to sealed  
keyboards switches coupled to a fabric. These switches  
30 may be coupled to the fabric by being embedded within the  
fabric, glued to the fabric, or sewn to the fabric. The  
metallic fibers terminate at an output configured for

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connection to an output. This output is configured to communication with a data processing system. The output may take the form of a physical connector, such as, for example, a universal serial bus (USB), or a wireless 5 communications unit. Further, section 102 may be a single unit with multiple switches that are selectively activated by a user applying pressure to the section. the pressure may be applied using a finger or a stylus. The selective activation of switches generates signals 10 that may control a pointer on a display.

With reference now to **Figure 2**, a diagram of a wearable keyboard is depicted in accordance with a preferred embodiment of the present invention. Wearable keyboard 200 in this example takes the form of a pair of pants with keys being located in regions 202 and 204. 15 A further feature of the present invention is found in the keys themselves. Each key or switch unit contains an electrically responsive liquid, which increases the rigidity of the key or switch unit when an electrical field, such as through an electric current, is applied to 20 this liquid.

Turning now to **Figure 3**, a block diagram of a data processing system is depicted in accordance with a preferred embodiment of the present invention. In this 25 example, data processing system 300 includes a bus 302, interconnecting processor 304, storage device 306, display 308, and keyboard 310. Processor 304 executes instructions located in storage device 306, which may take the form of memory, a hard disc drive, or some other 30 storage system. Display 308 functions to present information to a user and may take the form of a heads up

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display unit in these examples. Keyboard 310 is a wearable keyboard system.

Turning next to **Figure 4**, a block diagram of a wearable keyboard is depicted in accordance with a 5 preferred embodiment of the present invention. In this example, keyboard unit 400 contains keys or switches, which become rigid such that they can be sensed or detected by the fingers of a user. Keyboard unit 400 is connected to wireless unit 402, which provides 10 communication to a computer.

Turning next to **Figures 5A-5C**, diagrams illustrating a switch unit in a wearable keyboard is depicted in accordance with a preferred embodiment of the present invention. In **Figure 5A**, switch unit 500 is in an 15 unpowered mode. Switch unit 500 includes a capsule 502, which contains electrically responsive liquid 504. Electrorheological fluids are an example of an electrically responsive liquid, which may be used with switch unit 500. These types of fluids adhere to 20 electrodes and the volume of these fluids increase when an electrical field is applied. Further, the viscosity of the fluid increases in response to application of an electrical field.

Top portion 504 of capsule 502 is covered or 25 embedded within a fabric. Switch unit 500 also includes a switch 506, which takes the form of a piezoelectric-sensitive component. When switch unit 500 is in the unpowered mode, this component generates no current preventing a spurious keystroke input. In this 30 example, wire 508 connects switch unit 500 to a power

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source, while wire 510 leads to a keyboard sensing unit. These wires are embedded within the fabric.

In **Figure 5B**, switch unit 500 is now in a powered, but unpressed mode. In this example, capsule 502 is 5 stretched by internal pressure caused by the application of an electrical field to electrically responsive liquid 504. Switch unit 502 is now more rigid and easier to sense or detect by the fingers of a user. Power is supplied to switch unit 500 through wire 508. The 10 pressure within capsule 502 is sufficient to provide a feedback current indicating that the key can be activated.

In **Figure 5C**, switch unit 500 is now in a pressed mode. Pressure through a key press is illustrated in 15 section 512. This key press increases the pressure within capsule 502, causing switch 506 to generate a current that is detectable as a keystroke input. An alternate method in which these switches may be used might be as a drawing tablet or mouse cursor movement 20 panel; a large, square button with multiple sensors embedded in it would provide analogous pointing capability to those found on laptops for moving, pointing, and selecting an item on a computer display.

The description of the present invention has been 25 presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in 30 order to best explain the principles of the invention, the practical application, and to enable others of

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ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.